A Preliminary Evaluation of the Eating Quality of Meat Derived from Red Kangaroos

T. Marshall and B. L. McIntyre

Western Australian Department of Agriculture, Baron-Hay Court, South Perth, W.A. 6151

ABSTRACT

Taste panel assessments were conducted to gain information on the eating quality of kangaroo meat.

Meat, from six male and six female animals ranging in age from 1.5 to 9 years was assessed by taste panels for tenderness (on a six point scale), flavour (on a five point scale) and acceptability (on a six point scale). Three tasting sessions were conducted with a panel of between 11 and 22 tasters and on two occasions samples of beef were included.

There was a linear relationship ($p<.001$) between age and tenderness with meat from young animals being more tender than that from old animals and meat from females more tender than that from males ($p<0.01$). Neither age nor sex had any effect on flavour or acceptability.

It is argued that these differences in tenderness have little practical significance and that kangaroo meat derived from both female and male animals of a wide range of ages will be acceptable to consumers. The results also showed that kangaroo meat compared very favourably with beef.

INTRODUCTION

During 1988 the Western Australian Government decided to investigate the feasibility of allowing kangaroo meat to be sold for human consumption in the State. Part of the investigation included the determination of the likely consumer acceptance of the meat by taste panel assessments.

The nutritional properties of kangaroo meat (O'Dea 1988; Sinclair 1988) expected meat yields (Hopwood 1988) and the disease status of kangaroos taken from the wild (Andrew 1988) are detailed in the literature but no reports have been sighted on the eating quality of the meat.

Previous studies in Western Australia have shown that consumers consider tenderness and flavour to be the most important eating quality attributes of meat (Palmer and Frapple 1982; Frapple and Marshall 1984).

The work reported in this paper was conducted to provide information on the eating quality of kangaroo meat in terms of these criteria.

METHOD

Red kangaroos *(Macropus rufus)* were field shot during the night in an area approximately 1 200 km north of Perth. The carcases were bled and gutted immediately after shooting, and their age assessed by dentition before being inspected by a qualified health surveyor. They were placed in an abattoir chiller within two hours of sunrise on the morning after shooting and transported, under refrigeration, to Perth the following night. The skins remained on the carcases.

Following eight days storage in a commercial chiller (2-4°C) the carcases were boned out and the meat from the hind legs stored in labelled plastic bags in domestic chest freezers until thawed for tasting on three test days. On each tasting day meat from both sexes and a range of ages was included. The age and sex distribution of the samples and the number of tasters involved is given in Table 1.

Whole boned out legs were weighed, dusted with plain flour and roasted in "oven bags" in an electric oven at 200°C for approximately 20 minutes per 500 gm of meat.

Slices of meat, 6-8 mm thick, from each leg were divided into portions about 4 cm square and placed on plates for tasting. Each plate was identified by a code unknown to the tasters.

The tasters were aware that they were eating kangaroo meat but were not aware of the age or sex status of the samples. On each of the second and third tasting days two samples of beef (striploin), cooked in a similar manner, were included. On these days the tasters were not aware which samples were beef.

The beef samples used on day 2 were derived from Brahman cross steers aged about 3 years. The carcases were subjected to high voltage electrical stimulation within 60 minutes of slaughter. The beef used on day 3 was derived from similar carcases, again electrically stimulated, but which had been "aged" for eight days at 4-5°C prior to tasting.

Panelists were asked to record their assessments of tenderness on a six point scale from "very tender" to "very tough", flavour on a five point scale from "like very much" to "dislike very much" and acceptability on a six point scale from "very acceptable" to "very unacceptable".

On all three tasting days the meat was assessed by 10-13 people with previous taste panel experience with beef. On day 1, the meat was also tasted by a group from the kangaroo industry and the media who had no previous taste panel experience.

The panelists' assessments of tenderness, flavour and acceptability were subjected to an analyses of variance in order to test for differences due to age and sex of kangaroo, after adjusting for day of test. Within sample variation was used as the denominator for F-ratio tests.

RESULTS

Assessments made by inexperienced tasters did not differ from those made by experienced tasters, and results for all were included in the mean scores for tenderness, flavour and acceptability shown in Table 1.

Tenderness decreased linearly with age ($p<.001$, Slope= $-$ 0.1860) while meat from females was more tender than that from males (<.01; males 4.5; females 5.2).

There were no effects of age or sex on flavour or acceptability.

There was considerable variability between samples which could not be explained by age or sex.

DISCUSSION

Although based on a very limited sample the results of this study strongly suggest that kangaroo meat would be well received by consumers in terms of its eating quality attributes. They also indicate that the meat compared very favourable with beef.

While the statistically significant differences in tenderness scores among age groups and between sexes indicate a preference among the taste panels for meat from young females, it is unlikely that these differences are commercially important. Firstly, with only one exception tenderness scores for individual animals were 4.3 or higher on the 6 point scale. This is above the description of slightly tender (score 4.0) which, from our experience, is about the score normally attained for young, well finished beef which has been electrically stimulated. The beef used in this study had an average tenderness score of 4.1. Secondly, neither age nor sex had any significant effect on flavour or acceptability. Acceptability scores were often higher than corresponding tenderness scores and were never lower then 4.7. Also males tended to

Table 1. Mean taste panel scores of tenderness, flavour and acceptability according to species, age and sex.

Age (years)	Tenderness†		Flavour††		Acceptability†††		Day of test††††
Kangaroo	Male	Female	Male	Female	Male	Female	
9		4.3		4.1		4.9	1
8	3.5		3.9		4.7		1
7		5.5		3.8		4.7	2
7	4.9		3.8		5.1		2
4		5.6		4.2		5.3	1
4		4.5		3.5		4.8	2
4	4.4		4.1		5.0		1
4	5.3		3.7		5.2		2
3.5		5.5		3.9		5.5	3
3	4.5		3.6		5.7		3
2		5.5		3.7		4.7	3
1.5	5.2		4.1		5.2		1
Beef							
	4.7		4.0		5.2		2
	3.5		3.8		4.8		2
	4.5		4.1		5.3		3
	3.5		3.6		4.1		3

†Scores range from 1 (very tough) to 6 (very tender).
††Scores range from 1 (dislike very much) to 5 (like very much).
†††Scores range from 1 (very unacceptable) to 6 (very acceptable).
††††There were 22, 13 and 11 tasters on days 1, 2 and 3 respectively.

have higher acceptability scores than females despite having lower tenderness scores. The average acceptability score of the beef samples was 4.8.

It is possible that the eight day "ageing" period between slaughter of the kangaroos and the processing of the carcases had a beneficial effect on the resultant tenderness of the meat. However, such a situation is likely in practice where animals are shot in the field and stored for some time before processing. It should be noted that a similar ageing period was also applied to half of the beef samples included in the study.

The meat quality of kangaroo may be improved by the use of electronic stimulation as it is with other species. However, where animals are shot in the field and not refrigerated until some hours later, the slow rate of chilling of the carcase would make cold toughening unlikely. On the other hand, if the animals were killed in cold conditions, the relatively small carcase with low subcutaneous fat cover could be susceptible. The rate of post-mortem glycolysis of the muscle is also an important factor in cold toughening. We are not aware of any studies in this field and further investigation is required.

The results also have important implications for the management of kangaroo populations in that they showed that both female and male animals of a wide range of ages are likely to be acceptable for human consumption thereby allowing a balanced harvest of animals.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the permission of the joint Government/industry working party to use the data presented here and the assistance of Mr R. Munro who undertook the health inspections of the carcases, Mr D. Blackshaw who determined the age of the animals, Ms T. Hooper who prepared the meat samples for tasting and Mr M. D'Antuono and Mrs J. Speijers who performed the statistical analyses.

REFERENCES

ANDREW, A. E., 1988. Kangaroo meat — public health aspects. In *Kangaroo Harvesting and the conservation of arid and semi-arid lands.* Ed. by D. Lunney and G. Grigg. Proceedings of a Royal Zoological Society (NSW) Conference, May 14, 1988; University of New South Wales. Special edition of *Aust. Zool.* **24:** 138-40.

FRAPPLE, P. G. AND MARSHALL, T., 1984. Consumer opinions on beef quality, Tender Gold Beef and hogget branding. Western Australian Department of Agriculture.

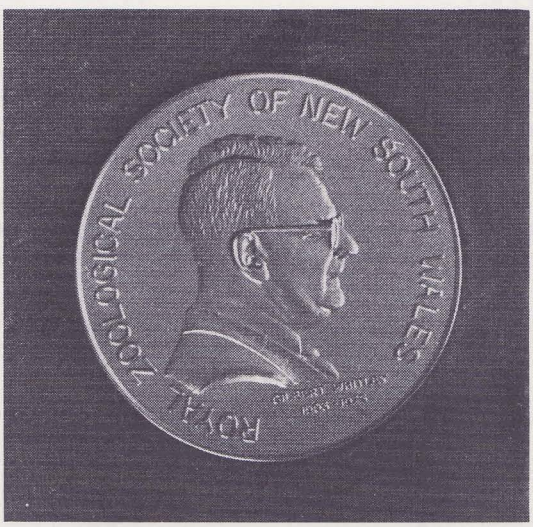
HOPWOOD, P. R., 1988. Kangaroos as game meat animals: Carcase meat yields and meat inspection. In *Kangaroo Harvesting and the conservation of arid and semi-arid lands.* Ed. by D. Lunney and G. Grigg. Proceedings of a Royal Zoological Society (NSW) Conference, May 14, 1988; University of New South Wales. Special edition of *Aust. Zool.* **24:** 168-76.

O'DEA, K., 1988. Kangaroo meat — polyunsaturated and low in fat: Ideal for cholesterol lowering diets. In *Kangaroo Harvesting and the conservation of arid and semi-arid lands.* Ed. by D. Lunney and G. Grigg. Proceedings of a Royal Zoological Society (NSW) Conference, May 14, 1988; University of New South Wales. Special edition of *Aust. Zool.* **24:** 140-43.

PALMER, G. K. AND FRAPPLE, P. G., 1982. Beef consumers and carcase branding. Western Australian Department of Agriculture.

SINCLAIR, A. J., 1988. Nutritional properties of kangaroo meat. In *Kangaroo harvesting and the conservation of arid and semi-arid lands.* Ed. by D. Lunney and G. Grigg. Proceedings of a Royal Zoological Society (NSW) Conference, May 14, 1988; University of New South Wales. Special edition of *Aust. Zool.* **24:** 146-48.

WHITLEY BOOK AWARDS 1989



Whitley Medal
"Fauna of Australia", Volume 1B
Volume Editors D. W. Walton and B. J. Richardson
Australian Government Publishing Service

Best Reference Book
"A very Elegant Animal — The Dingo"
by Roland Breckwoldt
Angus & Robertson

Best Children's Book
"Aldita and the Forest"
by Thelma Catterwell, illustrated by Derrick Stone
Houghton Mifflin

Best Issue of a Zoological Periodical
"Australian Natural History" Volume 22 (12)
edited by Fiona Doig and Georgina Hickey
Australian Museum

Best Field Guide
"Graeme Gow's Complete Guide to Australian Snakes"
by Graeme Gow
Angus & Robertson